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NOTES ON THE FLORA OF BOULDER COUNTY, COLORADO

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The Flora of Boulder County has been recorded in a volume of 311 pages by Professor F. P. Daniels (Univ. of Missouri Studies, science series, vol. II, no. 2, 1911), who catalogues 486 genera and 1,225 species. Since the publication of this work about 27 genera and 76 species have been added, principally from the observations of Messrs. D. M. Andrews and E. Bethel. A few species have been deleted, but in round numbers the Boulder County list includes 1,300 species of flowering plants and pteridophytes. Comparing this with an area of similar size in Switzerland, we find a striking correspondence:

Boulder County. Area 751 square miles. 1,300 species.
Canton of St Gallen. Area 779 square miles. 1,295 species.

The Rocky Mountains are much more ancient than the Swiss alps, but this fact appears to have little or no influence on the composition of the present flora. The Swiss alps are heavily glaciated, while the Rocky mountains of Colorado are almost entirely bare; the mountains of Switzerland are also much more closely grazed than ours, and the lowlands are more extensively and intensively cultivated. These differences would lead us to expect a larger flora in a corresponding area in Colorado than in Switzerland.

In 1906 Rydberg recognized 2,912 species of seed plants and pteridophytes for the whole of Colorado; while in 1909 Schinz and Keller listed 2,460 for Switzerland, the area of which is of course much less.

The genera added to the Boulder County list are the following:
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lowing: *Thelypteris*, *Polystichum*, *Notholæna*, *Marsilea*, *Eriophorum*, *Veratrum*, *Kochia*, *Norta*, *Hoffmanseggia*, *Diholcos*, *Phaca*, *Hedysarum*, *Callirhoë*, *Pediocactus*, *Chamaepericlimenum*, *Oreoxis*, *Phellopteris*, *Cymopterus*, *Navarretia*, *Asperugo*, *Myzorrhiza*, *Cucurbita*, *Leucelene*, *Brauneria*, *Coreopsis*, *Pericome*, *Nabalus*. Several of these, as the *Kochia*, *Norta* and *Asperugo*, are introduced plants, foreign to the native flora. *Norta altissima* (L.) Britton is a remarkable case. I first collected it in Boulder in July, 1915; now it is everywhere, one of the most abundant weeds. It is also to be seen in other parts of the west, as along the Union Pacific Railroad. There is some confusion about the Linnean name and Bonnier calls the plant *Sisymbrium pannonicum* Jacq. The British "London Catalogue" also uses this name. But the singular thing is the contrast between its behavior in this country and in Europe. It has been introduced in the British Islands, but remains a rare straggler, not established. Gaston Bonnier says that it is not found at any great altitude in the mountains; in France it occurs here and there, very rarely; in Belgium it is rare, and inconstant in the localities where it occurs; it is very rare in Switzerland. Why, then, has it taken our country by storm? *Asperugo procumbens* L. I collected in Boulder, May 8, 1916; but it has not spread to any extent, so far as I have observed. A very interesting escape is *Colutea arborescens* L. I recently saw it among a lot of wild flowers gathered by Miss Constance Fenton in Sunshine cañon. On making inquiry, I found that Mr. D. M. Andrews knew of more than one place near Boulder where it grew without cultivation. The Sunshine cañon locality was many years ago the abode of a solitary individual, who introduced various trees. Without attempting to review all the additions and changes in the list I note a few which seem of more general interest, or of which I have personal knowledge.

Quercus utahensis (A. D.C.) Rydb. Boulder (G. W. Letterman, 1854); Sargent, Trees and Shrubs, vol. 2. (1913), p. 222. It is safe to say that this species does not occur wild in Boulder County; there was probably some error in labelling. We have no native oaks.

Atriplex canescens (Pursh) Nutt. White Rocks, July, 1918, with galls of *Asphondylia neomexicana* Ckll. The White Rocks locality, northeast of Boulder, was botanically discovered by Mr. D. M. Andrews, who kindly took me over the ground. It is the type locality of *Asplenium andrewsii* Nels., which we saw growing on the face of the cliff. The White Rocks consist of Laramie sandstone, outcropping for a considerable distance along the creek, and possessing a flora which is, on the whole, very distinct from that of the surrounding country or the foothills. The fauna also doubtless differs. In my short visit I caught a southern bee, *Sphécodogastra texana* (Cresson) the genus and species new to Boulder County. The rocks are gay with *Helianthus petiolaris* Nutt. in July, and there is an abundance of *Prunus besseyi* Bailey with fine fruits.* Among the additions to the local flora discovered here by Mr. Andrews are *Abronia (Tripterocalyx) micrantha* Gray and *Rumex venosus* Pursh.

Another limited locality with a special flora is about four miles north of Boulder, on the road to Lyons, where the Niobrara shale outcrops. Here the specially characteristic plant, new to the local list, is *Delphinium geyeri* Greene. Here also is a quantity of *Hedysarum pabulare* Nels., also new to the list. These two very different and locally unique stations would well repay intensive study, which should if possible include the animals as well as the plants.

Aquilegia saximontana Rydb. has been found by Mr. Andrews above Silver Lake.

Camelina microcarpa Andr. The weed now common in Boulder is not *C. sativa*, as reported, but *C. microcarpa*. Dr. Rydberg, to whom a specimen was sent, agrees. Bonnier treats *microcarpa* as a subspecies of *sativa*.

Rosa pratincola angustiarum Ckll. Mr. Andrews found this on Wood Mountain, Sept, 3, 1914, and I noted that the fruits

*Mr D. M. Andrews has visited the exact locality of *Prunus prunella* Daniels, and finds the plants as described, but they are *P. besseyi*. W. F. Wight (Native American species of Prunus, p. 69) states that *P. prunella* is a form of *besseyi* with well marked leaf serrations. Rydberg, however, admits *P. prunella*, and places it in a different section from *P. besseyi*.

were dimorphic, depressed-globose or oblong. Where there are three fruits in a corymb, often two will be globose, with long peduncles, the third oblong. Some of the prickles are over 8 mm. long, and all are straight. I think this is a distinct species, *Rosa angustiarum*.

Rosa pratincola setulosa Ckll. will become *R. suffulta* f. *setulosa*.

Hoffmanseggia jamesii T. & G. was found by Mr. Andrews between Lafayette and Erie.

Aragallus. Our species are to be transferred to *Oxytropis*, and two new combinations appear to be necessary: *Oxytropis minor* (*Aragallus minor* (Gray) Ckll.), and *Oxytropis dispar* (*Aragallus dispar* Nels., *A. patens* Rydb.).

Viola Rafinesquii Greene is locally abundant at Boulder, but apparently has been introduced.

Pediocactus Simpsoni (Engelm.) Britt. & Rose is reported by Andrews from the high foothills north and south of Boulder, and the variety *minor* (*Echinocactus simpsoni minor* Engelm.) of the same from below Eldora.

Chamaenerion spicatum (Lam.) S. F. Gray f. *alba*, with white flowers, was found by me at Ward, 1917. The same variation (*alba* Hort.) is known in cultivation (cf. Standard Cyclop Horticulture).

Oenothera strigosa of the Boulder list is *O. cockerelli* de Vries.

Mertensia secundorum Ckll. does not seem to be the true *myosotifolia* Heller, from Red Cliff, nor can it well be *M. lateriflora* Greene, as Rydberg has it. I think it should be called *M. lanceolata* var. *secundorum*. The condition of affairs in the *M. lanceolata* group suggests the hybridization of two or more species, the ranges of which have come to overlap; but only experimental work can bring out the facts. Variability, with strongly heterozygous types, does not necessarily indicate hybridization; thus it exists in our district in *Ratibida columnifera*, which cannot well be suspected of any sort of bastardy.

Solanum elaeagnifolium Cav. was found by Andrews near Marshall; of course a stray.

Castilleja sessiliflora Pursh was collected at Boulder by Mr. E. Bethel, May, 1916. It has also been obtained since, and is

locally common. It is not quite the same as the eastern plants the calyx being more deeply cleft above than below; it may be named var. or subsp. *betheli*. I consulted Mr. Osterhout about the matter, and he found the same character in other specimens from various Colorado localities; near Windsor, Weld Co., Livermore in Larimer Co., and Julesburg. On the other hand, one from Wray, Yuma Co., near the Kansas border, appears to agree with eastern specimens.

Helianthus grosseserratus of the Boulder list is *H. coloradensis* Ckll.

I now have in the garden *H. parishii* Gray, obtained by Mr. Theodore Payne near Sevenoaks, in the San Bernardino mountains, California. To my surprise, it is nearly identical with *coloradensis*. The involucre bracts are shorter, and the leaves tend to be a little more distinctly dentate; but the plants are essentially of the same type, and there would be no serious objection to calling our plant *H. parishii coloradensis*.* The Californian *parishii* grows taller, up to 15 feet. I thought this statement might be an exaggeration, but it is confirmed by Dr. H. M. Hall. The Californian plant also presents a more pubescent type, *H. parishii* f. *oliveri* (*H. oliveri* Gray), which seems to be wholly lacking in our region. It is perhaps related to a maritime environment. The *H. coloradensis* at Boulder has an additional color-form (f. *sulphurea*, nov.), with pale or sulphur-colored rays. It was found by Mr. Andrews. The color is the or (gold) of Gravereaux's color chart, while the typical form is his safran (saffron).

Gymnolomia multiflora (Nutt.) B. & H. Dr. S. F. Blake, in his admirable recent revision of *Viguiera*, shows that this plant is quite distinct from the true *Gymnolomia*. It is the type of Nuttall's *Heliomerris*, but Dr. Blake refers it to *Viguiera*,

*Gaston Bonnier in his *Flora of France, Switzerland and Belgium*, and Hooker, in his *Flora of the British Islands*, retain the binomials for all the subspecies or races, a plan which has some advantages over that of trinomials, though it is too easily a source of confusion. Presumably a citation of the aggregate species is not to be taken as indicating necessarily the typical race, unless followed by "typica," or "s. str." Some compromise is necessary for convenience, as any system of nomenclature which expresses the actual facts in detail becomes too cumbersome for general use. The objection to recognizing two grades of species, each with binomials, is not so serious when there is a standard *Flora* in which all are described.

where with its allies it constitutes a group or section, distinguished by the absence of pappus and other characters. It is said to be a compact group of closely related species, well distinguished by habit and involucre. The group of *Viguiera* proper from which it arose appears to be extinct. All this should indicate a valid genus, and to it may be added the fact that in caustic potash the rays of *H. multiflora* turn bright red on the basal half. This is the color-reaction of the perennial sunflowers, but is not exhibited by the type species of *Viguiera*. Dr. Blake, in his prefatory remarks (Revis. *Viguiera*, p. 3), strongly objects to the use of such chemical tests in taxonomic work with composites, but I do not see why they are not as significant as various morphological data. I never proposed to use them alone. He objects that they cannot mean much, since a variety of unrelated genera agreed in their reaction. In this criticism he overlooked the fact that they agreed only in *not producing any red color*. After stating any morphological generic character, it could be added that numerous unrelated forms agreed in *not* possessing it. It is worth while to realize, through chemical tests, that things are not always what they seem. Thus the pure white rays of *Leucampyx newberryi* turn bright yellow in caustic potash, whereas ordinary white flowers, devoid of pigment, are unaffected.

The genus *Heliomeris*, limited and defined as a section by Blake, will stand as follows:

Heliomeris multiflora Nuttall.*

* Since writing the above, I have been able to make new studies of *Heliomeris multiflora* at Peaceful Valley, Colorado, altitude 8,000 ft. This is well above the zone of *Helianthus*, which was represented only by a single small *H. annuus lenticularis*, from an accidentally dropped seed close to the store. The following characters should be added to descriptions of *H. multiflora*. Acuminate ends of disc-bracts bright yellow; the bracts otherwise pure white, with a light but bright green keel down the back; but the outermost ones are also profusely speckled on the back with black (anthocyanin). Stigmatic branches pure orange. Rays emarginate at end; ray florets wholly without pistils.

Mixed with the typical form was a very interesting mut. *Apicalis*, nov.; with the apical third of the rays at full maturity creamy-white, abruptly contrasting with the bright yellow basal two-thirds. When the flowers first come out, the apical part is yellow, but a shade paler than the rest. This is very significant in relation to the patterns in the rays of *Helianthus*. The species of *Rudbeckia* show

- Heliomeris nevadensis* (*Gymnolomia nevadensis* Nelson, 1904).
Heliomeris brevifolia (*Gymnolomia brevifolia* Greene, 1913).
Heliomeris longifolia (*Gymnolomia longifolia* Rob. & Greenm., 1899).
Heliomeris annua (*Gymnolomia multiflora annua* Jones, 1895).
Heliomeris hispida (*H. multiflora hispida* Gray, 1853).
Heliomeris hispida ciliata (*Gymnolomia hispida* var. *ciliata* Rob. & Greenm. 1899).
Heliomeris porteri (*Rudbeckia porteri* Gray; *Gymnolomia porteri* Gray).
Heliomeris obscura (*Gymnolomia obscura* Blake, 1916).
Arnica monocephala Rydb. becomes *A. pedunculata* Rydb. f. *monocephala*.

BOULDER, COLORADO.

THE HAWAIIAN SUMACH

NENELEAU; *Rhus semialata* VAR. *sandwicensis* ENGLER

BY VAUGHAN MACCAUGHEY

In 1917 the author published an annotated list of the forest trees of the Hawaiian Archipelago, in the Bulletin of the Torrey Botanical Club (44: 145-157). In the Botanical Gazette (64: 89-114, Aug. 1917) he described in detail the unparalleled endemism of the Hawaiian flora, especially the arborescent flora. The present paper deals with an endemic tree, the Hawaiian sumach, the sole native representative of a large and important tropical family. At present there is no detailed account of this tree in the literature. The Hawaiian sumach is a small tree, white patches on the rays is fading, but these are irregular. In the palest forms of *Helianthus annuus* obtained by my wife in her cultures, the rays are at first light yellow throughout, but at full maturity are pale yellowish basally, shading into white apically; but the transition is not abrupt as in the *Heliomeris*.

The insect-visitors of *H. multiflora* were noted, and consisted of the following bees: *Bombus bifarius* Cresson, *Panurginus parteræ* Ckll., *Halictoides cryx* Vier., *Halictus cressoni* Rob., and the honey-bee; also the fly *Eristalis latifrons* Lev., and the plant-bug *Ligyrocaris contractus* Say. *Phacelia* and *Monarda* at the same place were visited by almost entirely different sexes of bees, belonging to other genera in the main: e.g. *Anthophora* on *Monarda*, *Osmia* and *Anthidium* on *Phacelia*